

BELLCOMM, INC.

955 L'ENFANT PLAZA NORTH, S.W.

WASHINGTON, D. C. 20024

B70 09083

SUBJECT: Voice Communications Observations  
During Countdown and Launch of  
Apollo 13 - Case 900

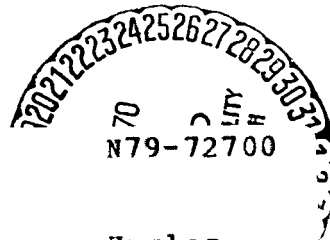
DATE: September 30, 1970

FROM: L. A. Ferrara  
J. T. Raleigh

ABSTRACT

Voice communications between KSC test personnel and the spacecraft were monitored during the Apollo 13 launch countdown. The communications facilities supported the prelaunch mission requirements satisfactorily. Voice signals from the spacecraft were observed to be occasionally distorted on OIS channel 214 when it was patched to the VHF ground receiver output. There were also a few instances of low voice signal levels when Houston Flight was transmitting to the spacecraft. It is proposed that communications interface problems such as these could be resolved by a small intercenter technical committee.

(NASA-CR-113926) VOICE COMMUNICATIONS  
OBSERVATIONS DURING COUNTDOWN AND LAUNCH OF  
APOLLO 13 (Bellcomm, Inc.) 8 p



Unclas  
00/32 11910  
8 9 10 11 12

FF No. 60:

CR-113926  
(NASA CR OR TMX OR AD NUMBER)

(CATEGORY)

SUBJECT: Voice Communications Observations  
During Countdown and Launch of  
Apollo 13 - Case 900

DATE: September 30, 1970

FROM: L. A. Ferrara  
J. T. Raleigh

MEMORANDUM FOR FILE

1.0 INTRODUCTION

Voice communications between the Apollo 13 crewmen, key test personnel at KSC and flight control personnel at MCC were monitored from the back up crew communications checks at T-9<sup>h</sup>:45<sup>m</sup> until loss of signal at the Canary Islands MSFN Station (T + 24 minutes - Ground Elapsed Time). The KSC Operational Intercomm System (OIS) supported the prelaunch activities without notable incident. There were a few technical and/or procedural communications problems primarily related to low level voice signals from MCC and distorted VHF down-voice from the spacecraft as observed on OIS channel 214. These problems were similar to those noted during the Apollo 13 CDDT and those reported by local KSC personnel during the Flight Readiness Test. These anomalies, however, were never serious enough to disrupt communications or to delay the countdown. Section 2.0 of this memorandum lists the significant observations, and Section 3.0 discusses the air-to-ground voice communications configuration and offers possible explanations of the observed items along with considerations to improve the communications problems.

2.0 OBSERVATIONS

Observations reported herein were made on circuits monitored by L. A. Ferrara in the back up Firing Room (#2) of Launch Complex 39 and J. T. Raleigh in the North American Rockwell Communications Laboratory (MOLC) in the Manned Spacecraft Operations Building.

Times quoted are local KSC time (EST)

Back-up Crew Comm Checks

Fri. 4/10/70  
1846  
(T-9:14)

GMIL (MSFN Ground Station at Merritt Island) reports receiving noisy data from spacecraft. They were informed that the Mobile Service Structure was still moving.

1854 LMP reported he had to increase his VHF AM radio in the spacecraft to full volume in order to hear the count.

1857 CDR sounded distorted with background noise on VHF as heard on channel 214. LMP was also slightly distorted. The same VHF signal as heard on monitor speakers from separate wide-bandpass telemetry receivers in MOLC sounded loud and clear without the distortion as heard at LC 39 on ch. 214.

Sat. 4/11/70 Launch count  
1058 GMIL inquired about the up link voice quality on VHF and USB as heard in MOLC - MOLC responded U/L voice was good quality.

1130 VHF signal strength variations on 296.8 MHz reported by MOLC on channel 213.

1142 Random noise reported by MOLC modulating the 296.8 MHz VHF uplink about 10%. GMIL stated the noise was probably coming from A/G Long Lines Circuit to Houston which was connected to VHF transmitter at GMIL. (GMIL enabled VHF constant key at 1110.)

1147 Spacecraft crew had to increase volume on VHF to get loud and clear signal. MSTC made no comment on this.

1148 MOLC reported on channel 213 that there was low S-Band up link modulation level on the signal from GMIL.

1151 MOLC reported on channel 213 that the first VHF uplink radio check was not VHF only, it was simultaneous (simo) VHF and USB.

1152 Houston Flight reports he hears the spacecraft loud and clear. The crew reported they heard Houston low but satisfactory. MSTC did not comment on the net about the low level.

1153 MOLC reported to GMIL that they transmitted satisfactorily in the SIMO mode but that USB was of lower than normal level.

- 1155 Houston Flight sounded low in level on channel 214. MCC was not immediately aware of the command problem with ABORT B LAMP. (The abort command was not received in the spacecraft the first time and had to be retransmitted.) MSTC apparently resolved the problem with off-net telephone conversations.
- 1333 VHF Uplink (296.8) signal reported varying + 3 dB by MOLC. MCRF reported signal steady. Problem was believed caused by multipath condition due to Swing Arm-9 position which was not brought to full retract until 1406.
- 1352 HFLT was very low level during the T-20<sup>m</sup> azimuth update verification. MSTC told HFLT he was low and subsequently the signal level on ch. 214 improved slightly.
- 1400 LMP sounded distorted on VHF as heard on channel 214 during the T-15 minute comm check.
- 1413 Lift-off-voice communications as heard at LCC-39 on GOSS Conference (Channel 125) was continuous and of good quality. There seemed to be an occasional beginning of word syllable clipping from CAP COMM in Houston although the crew in their post flight debriefing declared launch communications were good and CDR Lovell stated they were better than during Apollo 8.<sup>1</sup>

Figure 2 is a functional block diagram of the voice signal path from MCC to the spacecraft at the launch pad. It can be seen that normal KSC originated operational traffic on channel 214 will give a certain level signal to modulate the GMIL transmitters and it is used to set the volume thumbwheels in the spacecraft for a comfortable listening level. When Houston Flight transmits on A/G Long Lines, if his signal level is not nearly equal to that of the previously adjusted KSC traffic, the spacecraft must readjust their volume. Likewise variations in the signal level of the GOSS Conference - Net 1 (when it is connected after tower clear) path from Houston may necessitate changes in volume settings in the spacecraft. In a worse case consideration, if the spacecraft sets the volume levels proper for KSC originated

---

1. Apollo 13 Technical Crew Debriefing, April 24, 1970, Manned Space Craft Center, Houston, Texas (C).

communications, it is possible that the spacecraft may not hear the low level signals from Houston. This is particularly hazardous during the launch phase when the spacecraft volume settings are difficult if not impossible to adjust from all positions.

### 3.0 APOLLO PRE-LAUNCH AIR-TO-GROUND VOICE COMMUNICATIONS



#### CONFIGURATION.

Two communications problems worthy of note were observed during the preparations for the launch of Apollo 13:

- (1) Occasionally distorted VHF voice from the spacecraft as heard on OIS channel 214. It occurred in varying degrees during FRT, CDDT and launch.
- (2) Low level voice signals from MCC, requiring an increase in the previously set volume controls in the spacecraft so the crew could hear satisfactorily.

Figure 1 is a functional block diagram of the spacecraft-to-ground station voice receiver configurations. The occasional distortion of VHF voice was only heard on OIS channel 214. Other channel 214 traffic sounded normal. S-Band spacecraft voice on channel 212 was not observed to be distorted, nor was any distortion observed on either link (VHF or USB) at the output of independent receivers at the MOLC monitoring station. The distortion would seem to be localized at the VHF receiver/Astro comm voice channel interface at GMIL. While the distortion was not as troublesome nor consistent as that which was experienced during Apollo 7, certain similarities to Apollo 7's VHF distortion problems were observed. This type of problem may be appropriately handled by a small intercenter interface committee because they involve areas of technical responsibility that may be overlapping.

2034-LAF  
JTR-pjr

  
J. A. Ferrara  
  
J. T. Raleigh

Attachment

Figures 1 & 2

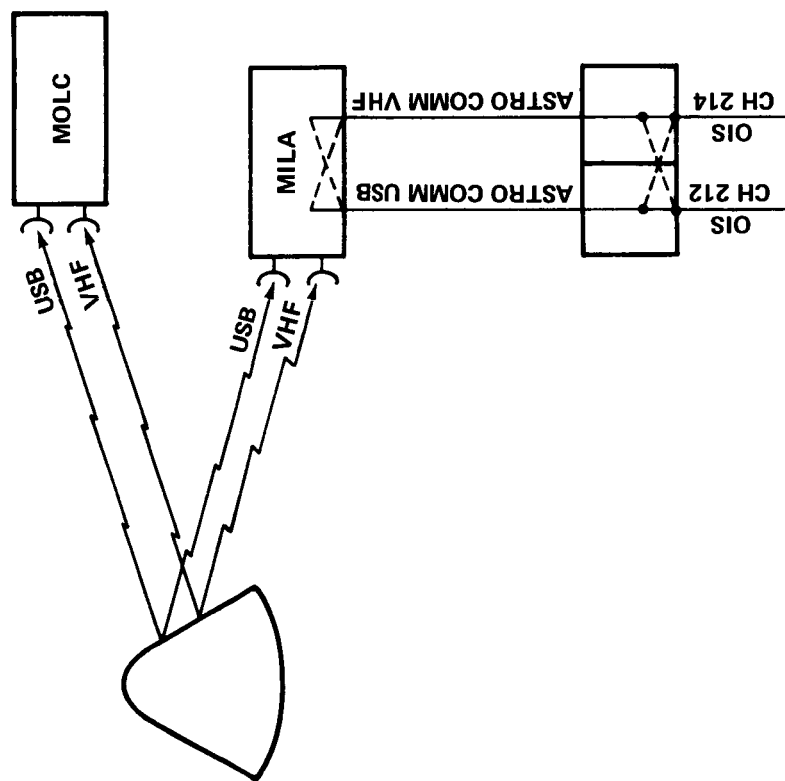


FIGURE 1 - SPACECRAFT TO GROUND VOICE COMMUNICATIONS PATH (PRE-LAUNCH)

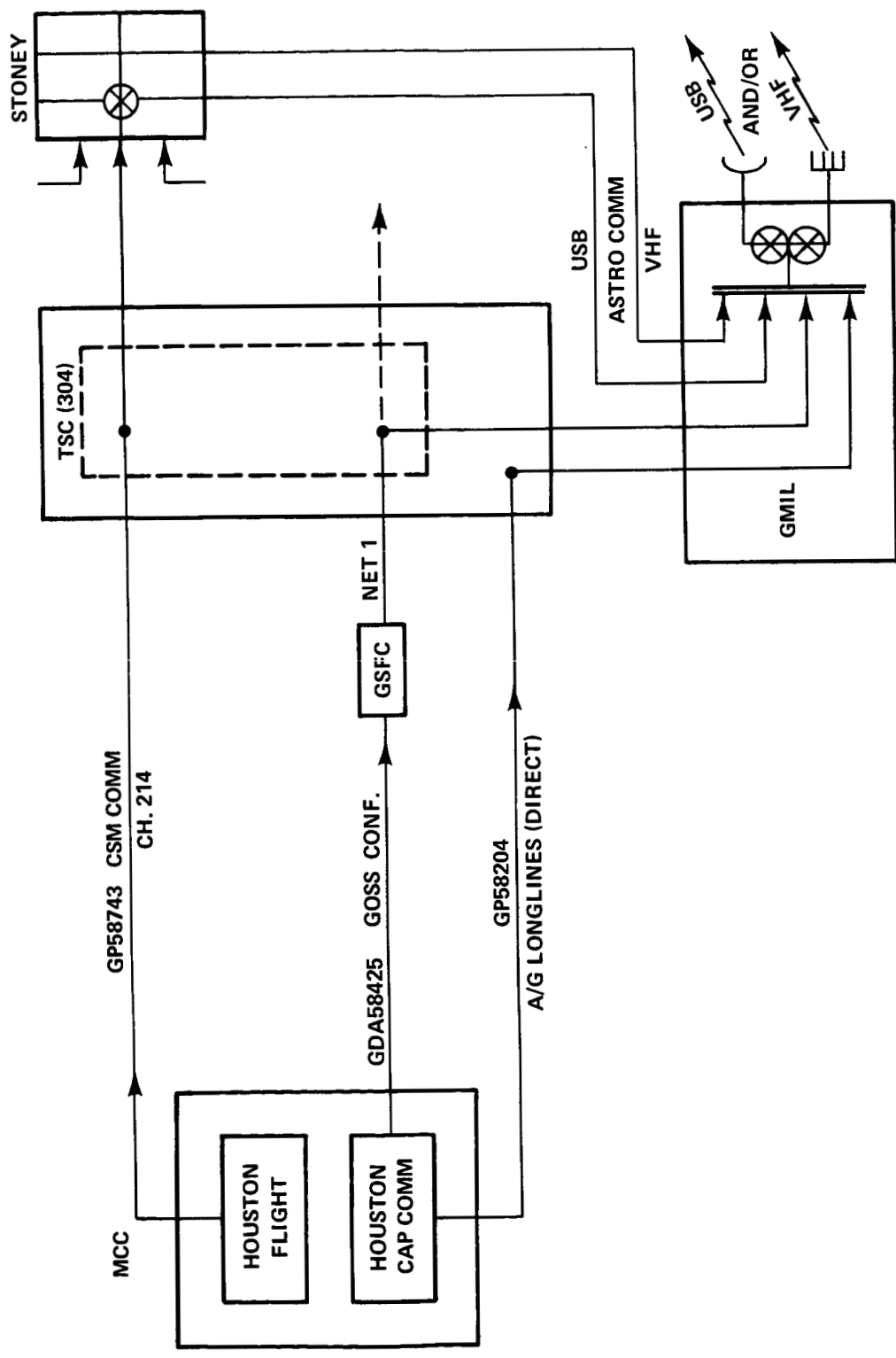


FIGURE 2 - MCC TO SPACECRAFT VOICE COMMUNICATIONS CONFIGURATION

**BELLCOMM, INC.**

Subject: Voice Communications Observations  
During Countdown and Launch of  
Apollo 13 - Case 900

From: L. A. Ferrara  
J. T. Raleigh

DISTRIBUTION LIST

NASA Headquarters

W. B. Evans/MLO  
J. K. Holcomb/MAO  
C. M. Lee/MA  
A. S. Lyman/MR  
J. T. McClanahan/MOR  
W. E. Miller, Jr./MOG  
J. D. Stevenson/MO

GSFC

J. E. Dowling/820  
R. K. Owen/810

KSC

R. A. Browne/INS-OIS  
A. Kempson, Jr./DE-ESD-4  
P. A. Minderman/TS  
A. J. Parrish/INS-OIS-2

MSC

C. W. Busch/FS4  
J. A. Frere/FS4

Bellcomm, Inc.

W. J. Benden  
A. P. Boysen, Jr.  
R. K. Chen  
J. P. Downs\*  
D. R. Hagner  
J. J. Hibbert  
N. W. Hinnert

Bellcomm, Inc. (Continued)

J. E. Johnson  
H. Kraus  
J. P. Maloy  
J. Z. Menard  
B. F. O'Brien  
I. I. Rosenblum  
I. M. Ross  
N. W. Schroeder  
J. W. Timko  
R. L. Wagner  
A. G. Weygand  
M. P. Wilson  
W. D. Wynn  
Department 1024 File  
Central Files  
Library

\*Abstract Only